

The Relationship between the Selected Macroeconomic Variables and Stock Prices: An Analytical Study in India

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Abstract

The movement of macroeconomic predictors is always more and less determining factors of stock prices. It always strikes the mind of investors or financial decision-makers which type of relationship found between the macroeconomic variables and stock prices in India. To support the answer, the study has used selected macroeconomic variables (i.e., IIP and CPI as a proxy of GDP and inflation respectively) and stock prices (i.e., S&P BSE Sensex Index) to verify the relationship during the period from 2005 to 2022. By using OLS, the study found that the IIP has a significant positive relationship with stock prices and CPI has a significant negative effect on stock prices in India. The result of Granger causality we found a unidirectional relationship from IIP to SP and SP to CPI while bidirectional causality between the variables in the short-run during the period. Overall, we found that the macroeconomic variables (i.e., IIP and CPI) have a significant and causal relationship with stock prices in India.

Keywords: Macroeconomic Variables, GDP, Inflation, Stock Prices

1. Introduction

In the growing era, each country is trying to make their country sustainable growth in each field and economic growth is one of the crucial environment in the sustainable growth of the country. The stock market is one of the major determinants of the Indian economy and the movement of macroeconomic variables has a significant effect on stock prices. To verify the effect, the study used a few selected macroeconomic variables (i.e., IIP and CPI as a proxy of GDP and inflation)

The GDP of the nation is one of the crucial measures that represent the economic and financial strength of the country. It is one of the significant macroeconomic determinants of the motion of stock indices in the Indian capital market (Ray, 2012; Laichena and Obwogi, 2015; Chandrashekhara et al., 2018; Othman & Al-Kassab, 2022). Here, a positive significant relationship with GDP was found with the movement of stock prices by Ray (2012); Hunjra et al. (2014); Leong and Hui (2016); Demar (2019); and Queku, Gyedu, and Carsamer (2020).

For the last few years, the Indian stock market is found highly volatile and investors are facing a lot of problems with investing in particular securities at the right time. As the GDP and Inflation are the major macroeconomic elements that are influencing the Indian economy and also the Indian capital market. Incognizant investors invest their money without considering macroeconomic information and predictors.

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Looking at the above-discussed macroeconomic variables, the study needs to know what relationship between the GDP and CPI exists with Stock Indices in the Indian stock market.

The numbers of the existing literature are depicting that the GDP is significantly influencing SP. Most of the authors found there is a favorable relationship between SP and GDP. Denying this outcome, some authors also found a negative relationship between GDP and SP. Similarly, there is a significant difference between INF and SP, and also found both positive and negative relationships between variables by some authors. The outcomes of the literature found that there is causality between the unidirectional and bidirectional relationships among variables. However, in some literature, it is found no causal relationship. Keeping consideration of the existing contradictory result, the study is trying to check the exact relationship by taking some analytical objectives as follows

2. Literature Review

A comprehensive survey of the existing literature has been conducted in both global and Indian contexts on the relationship between macroeconomic predictors and stock indices. The current study emphasized the dynamic relationship among two key macroeconomic variables i.e., GDP and INF and Stock Price (S&P BSE 100). This study reviewed the literature in the following way:

2.1. Gross Domestic Product (GDP) and Stock Prices

The relationship between economic development and the market indices movement was extensively studied earlier. In the recent past, this relationship attracts the attention of researchers in economic and financial areas. Ray (2012), Demir (2019), Liya et al., (2021), Olokoyo et al. (2020), and Othman & Al-Kassab (2022), pointed out that Gross domestic product is positively influencing Stock Indices in the Indian capital market. The study by Hunjra et. al. (2014), has found that the GDP does not have the Granger cause with Pakistan stock prices but it has a strong positive relationship with stock prices. The study by Loo, Anuar, and Ramakrishnan (2016) suggests that the Malaysian stock market i.e., REIT is greatly influenced by the movement of Gross Domestic Product in Malaysia and they also argued that the REIT market index is cointegrated with GDP.

Similarly, sector-wise GDP is found to be a significant relationship with Stock prices in the Indian stock Market (Acharya and Mahapatra, 2018). Chandrashekhar et al. (2018), made up a panel research study on macroeconomic variables and stock prices of two nations (India and Brazil). By using Dynamic Ordinary Least Square (DOLS) they revealed that GDP had a significant positive relationship with stock prices in both countries. In the cross nations' i.e., India and America, study on stock indices and macroeconomic predictors during the period from 2015 to 2019, Shoo, Patnaik. and Satpathy (2020) established the bear-on macroeconomic variable (GDP) on both SENSEX (BSE Index) and DOW JHONES (America). The current study shows the impact of GDP on stock indices is quite significant but negative in a weak form.

Considering smooth time series data from 2014-2019, Huy, Loan, and Anh (2020) conducted a study on the impact of Gross Domestic Product (GDP) on stock prices (VCB) in Vietnam and the empirical result has shown a statistical favorable relationship between GDP and VCB stock indices by using correlation matrix and regression analysis.

2.2. Inflation Rate and Stock Prices

There is a statistical co-integration between inflation and stock indices, revealing that inflation has a statistical long-run relationship with stock indices in India (Pal & Mittal, 2011; Liya et al., 2021); Othman and Al-Kassab 2022). Asaolu et al. (2010) in their study found that Inflation has a long-run relationship with stock prices, which is known from the Johansen co-integration. By using VECM analysis, found that there is a weak relationship between Average Share Price (ASP) and Inflation in Nigeria (Habib and Islam, 2017). Tripathy (2011), the significance and bidirectional causal relationship found between Stock Prices and Inflation in India.

Again, considering the smooth and turbulent period of the study, Mumo (2017); Megaravali and Sampagnaro (2018) studied the relationship of the macroeconomic factors with stock indices in the Nairobi Securities Exchange (NSE), Kenya. The co-integration and VECM analysis found that Inflation has an insignificant negative relationship with stock values in the long run, but did not have any short-run relationship. This analysis includes the gross payoff of REIT Indices from Singapore, Hongkong, Thailand, Japan, Malaysia, Taiwan, and South Korea. REIT markets in Thailand and Malaysia have an influence on inflation in the long haul (Loo, Anuar, and Ramakrishnan, 2016; Baranidharan and Dhivya, 2019). Similarly, according to Bhattacharjee and Joy (2020), inflation is positively significant to stock indices in the long haul, as supported by Alshami & Ibrahim, 2013. Keeping consideration of the existing contradictory result, the study is trying to check the exact relationship by taking some analytical objectives as follows.

3. Research Objectives and Hypothesis

3.1. Objectives

This study tries to establish the relationship between the macroeconomic variables (i.e., Index of Industrial Production and Consumer Price Index) and stock prices in India. The study object to checking the significant effect on stock price and the causality relationship between the macroeconomic variables and stock prices.

3.2. Hypothesis

As per the current research objectives, the study developed the following research hypothesis to examine the significant relationship among the variables.

H₁: The macroeconomic variables (i.e., IIP & CPI) have a significant impact on stock prices.

H₂: There is a significant causal relationship between the macroeconomic predictors and stock indices in the India.

4. Data and Methodology

4.1. Data

The analytical study is trying to establish and check the relationship between the considered macroeconomic predictors (i.e., IIP & CPI) and stock indices in the Indian context. The analytical study purely lies on the secondary sources data which is accessed from different sources of databases and websites. This study considers 17 years of monthly time series data from 2005 to 2022. The RBI database is used for the collection of monthly IIP and CPI data (i.e., www.dbie.rbi.org.in) and the monthly BSE Sensex Index is collected from the BSE website (www.bse.org.in). The study converts the raw data into a natural log for the purpose of saving from outliers' problems and the skewness of the data (Bhattacharjee and Das, 2021)

4.2. Methods

The ordinary least square (OLS) regression method is used to check the explaining power of independent variables on the dependent variable and the Granger causality test is used to check the unidirectional or bidirectional or no causal relationship between the IIP, CPI, and SP.

$$LNSP_t = \alpha_0 + \beta_1 LNIIP_t + \beta_2 LNCPI_t + \epsilon_t$$

Where 't' refers to the time in the year, ' β ' coefficient measures the slope of independent variables, and ' ϵ_t ' is the random variable disturbance term.

5. Results and Discussions

Table 1: Description of Variables

Variables	Acronym	Measurement
BSE Sensex	SP	The S&P BSE Sensex Index is taken for the purpose of the dependent variable in the model.
Index of Industrial Production	IIP	The Index of Industrial Production is taken as the proxy of GDP which is one of the major determinants of stock prices.
Consumer Price Index	CPI	The Consumer Price Index is considered as a proxy of inflation which is also one of the major determinants of the movement of stock prices

5.1. Summary Statistics

Table 2 reveals the descriptive statistics of the log-transformed variables. The descriptive analysis reveals that there is negligible variation between the mean and median of each variable i.e., 10.00 & 9.92, 4.66 & 4.68, and 4.62 & 4.73 for log of stock prices (LNSP), log of IIP (LNIIP) and log of CPI (LNCPI) respectively. The standard deviation of LNSP is found to be 50% deviation from the mean, similarly, LNIIP is found to be 20% deviation from the mean, and LNCPI was found to be 34% deviation from the mean which signifies the lack of stability of variables during the study period. The

probability value of the Jarque-Bera test of stock price is insignificant which indicates the data is normally distributed, while IIP and CPI are found to be significant which shows the data is not normally distributed during the study period.

Table 2: Summary Statistics of LNSP, LNIIP, and LNCPI

	LNSP	LNIIP	LNCPI
Mean	10.00631	4.655666	4.620357
Median	9.928740	4.681668	4.732684
Maximum	10.99048	5.002603	5.122177
Minimum	8.724929	3.988984	3.987790
Std. Dev.	0.500306	0.197904	0.347523
Skewness	-0.135365	-0.841444	-0.377749
Kurtosis	2.537297	3.361322	1.782201
Jarque-Bera	2.442805	25.18267	17.45739
Probability	0.294816	0.000003	0.000162
Sum	2041.288	949.7560	942.5527
Sum Sq. Dev.	50.81204	7.950684	24.51681
Observations	204	204	204

Source: The authors

5.2. Regression Analysis

Table 3 represents the interrelationship between the IIP and the CPI on SP. The significant value of IIP is 0.00 and it is less than 0.05, which means the IIP has a significant relationship with stock prices. Similarly, the significant value of CPI is 0.00 which is also less than 0.05, means the CPI has a significant effect on stock prices during the study period. The probability value of F-statistics is significant which means the macroeconomic variables (i.e., IIP & CPI) have a significant relationship with stock prices. Looking into R^2 value, the predictor variables have 63% explaining the stock prices. The Durbin-Watson statistic is 1.99 and the value is nearest to 2, which means the value is nearer to zero autocorrelation and the model is assumed to be the best fit.

Table 3: The linear regression statistics of ER, UR, and GDP

Dependent Variables: LNSP

Method: Least Squares

Sample: 2005M04 2022M03

Included Observations: 204

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.848991	0.310757	2.732008	0.0069
LNIIP	0.920857	0.09992	9.209267	0.0000
LNCPI	-1.109974	0.070400	-15.76672	0.0000
DGFC	-0.356716	0.038331	-9.306096	0.0000
DCOV	0.203335	0.035322	5.756601	0.0000
R-squared	0.631534	Mean dependent var		10.00631
Adjusted R-squared	0.620157	S.D. dependent var		0.500306
S.E. of Regression	0.132220	Akaike info criterion		-1.184501
Sum squared resid	3.478920	Schwarz criterion		-1.103175
Log Likelihood	125.8191	Hannan-Quinn criterion		-1.151603
F-statistic	676.8833	Durbin-Watson statistic		1.996028
Prob (F-statistic)	0.000000			

Source: EViews result by Authors

5.3. Diagnostic Tests

The following diagnostic tests must be applied to verify the model is out of spurious:

- Serial Correlation
- Heteroscedasticity
- Residual Normality Tests

a. Serial Correlation

The hypothesis is framed to check the autocorrelation within the model as:

H_0 : No serial correlation in the model.

H_1 : There is a serial correlation in the model.

Table 4 shows the probability value of the F-statistic is 0.35 and is greater than 0.05, which means the null hypothesis is accepted and found no autocorrelation within the model

Table 4: Breusch-Godfrey Serial Correlation LM Test

F-statistic	121.7958	Prob. F (2,4)	0.3584
Obs. R-squared	112.7863	Prob. Chi-Square (2)	0.3084

b. Heteroscedasticity

The robustness of OLS output is checked by using the Heteroscedasticity test. The Hypothesis is:

H_0 : No Heteroscedasticity

H_1 : Presence of Heteroscedasticity

Table 5 shows the F-statistic significant value is 0.91 which is greater than the value at 5% level of significance, which means there is the presence of homoskedasticity in the model.

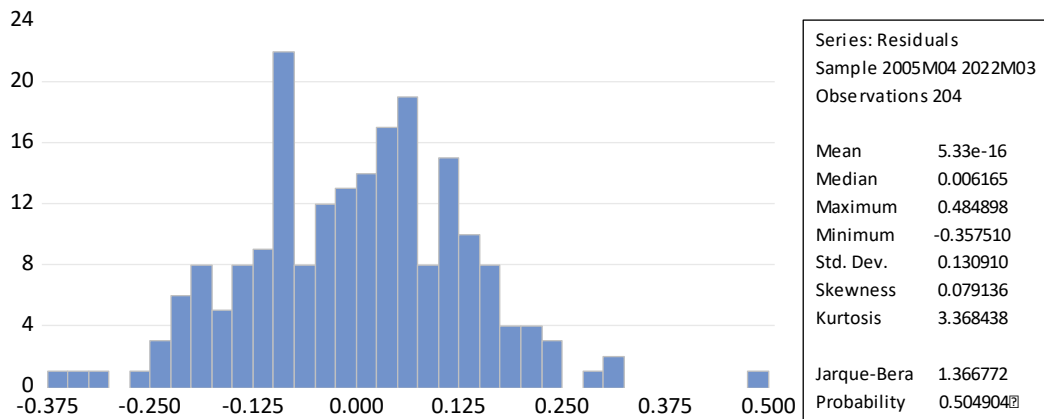
Table 5: Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	19.75469	Prob. F (3,6)	0.2537
Obs*R-squared	57.98108	Prob. Chi-Square (3)	0.2486
Scaled explained SS	65.33775	Prob. Chi-Square (3)	0.2045

c. Residual Normality

Figure 2 depicts the residual normality test of variables together. The significant value of residuals is 0.64 which is greater than the value of 0.05, which means the null hypothesis is accepted and the residuals are normal.

Figure 2: Histogram of residuals and Jarque-Bera Test



5.4. Causality Test

As SP, IIP, and CPI have common stochastic trends, the Granger Causality test is pioneered by Engle and Granger (1987), and used to verify short-run causality between the considered variables. Table 6 reveals the result of the pairwise causality between the variables. The result shows the existence of a unidirectional relationship between LNIIP to LNSP and LNSP to LNCPI which means IIP is causally influencing SP while CPI is causally influenced by SP in the short-run. However, found a bidirectional causal relationship between IIP and CPI which means both are causally influencing each other in the short-run during the study period.

Table 6: Granger-Causality Test

Pair	Null Hypothesis.	F-Statistic.	Prob.	Implication
SP and IIP	LNIIP does not Granger Cause LNSP.	0.41820	0.8663	Unidirectional causality
	LNSP does not Granger Cause LNIIP.	4.57376	0.0002	

SP and CPI	LNCPI does not Granger Cause LNSP	2.22006	0.0430	Unidirectional causality
	LNSP does not Granger Cause LNCPI	1.05615	0.3907	
IIP and CPI	LNIIP does not Granger Cause LNCPI	1.83368	0.0947	Bidirectional causality
	LNCPI does not Granger Cause LNIIP	4.47445	0.0003	

Source: The Authors

6. Conclusion and Suggestions

6.1. Conclusion

As earlier discussed, the BSE Sensex Index as a proxy of Stock Prices (SP), IIP as a proxy of GDP, and CPI as a proxy of Inflation performs a crucial role in determining the economic growth of a country (Bhattacharjee & Das, 2021). The analytical study is trying to know the regression relationship between the variables and the causality relationship between the variables during the period from 2005 to 2022.

The study has applied descriptive statistics to feel about the character of the data and out of which, IIP and CPI are found non-normal while in the case of SP, it is found normal. The OLS regression result reveals that the IIP has a significant positive effect on SP and inflation (i.e., CPI) has a negative effect on SP. Overall, the p-value of F-statistics also depicts that macroeconomic predictors have a significant influence on SP. The Granger Causality test, developed by Engle and Granger (1987), is used to investigate the short-run causation between the variable. The Granger causality test found unidirectional causality in the case of IIP to SP and SP to CPI (Ray, 2012) while bidirectional causality between the variables in the short run during the period.

Hence, it is concluded that the Stock Prices, Gross Domestic Product, and Inflation have significant as well as causal relationships, which means the macroeconomic variables like GDP and inflation are significantly and casually influencing the SP in the Indian capital market.

6.2. Suggestions and Limitations

The analytical study helps the investors, to be aware at the time of investment decision in the stocks while volatility in GDP (i.e., IIP) and inflation (i.e., CPI). The policymaker should give concentration on the movement of IIP and inflation. The study considered only three variables with 17 years of data which may not be sufficient for the lucid application. So, it may go through more variables with more periods of data.

References

- Acharya, P.N. and Mahapatra, R.P., 2018. MACRO ECONOMIC FACTORS AND SHARE PRICE BEHAVIOUR: A STUDY ON SELECTED INDUSTRIES IN INDIA. *Parikalpana: KIIT Journal of Management*, 14(1).

- Baranidharan, S. and Dhivya, N., 2019. Empirical relationship among various macroeconomic variables on Indian Stock Market and Japanese Stock Market. *International Journal of Multidisciplinary Educational Research*, 8(4), pp.17-35.
- Bhattacharjee, A. and Das, J., 2020. Do Indian stock prices respond to domestic macroeconomic variables. *NMIMS Management Review*, 38(3), pp.55-71.
- Bhattacharjee, A. and Das, J., 2021. Investigating the Long-run and the Short-run Relationship Between Domestic Macroeconomic Forces and Indian Equity Market: Evidence Based on ARDL Bounds Testing Approach. *Paradigm*, 25(1), pp.61-76.
- Chandrashekar, R., Sakthivel, P., Sampath, T. and CHITTEDI, K.R., 2018. Macroeconomic variables and stock prices in emerging economies: A panel analysis. *Theoretical & Applied Economics*, 25(3).
- Demir, C., 2019. Macroeconomic determinants of stock market fluctuations: The case of BIST-100. *Economies*, 7(1), p.8.
- Engle, R.F. and Granger, C.W., 1987. Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, pp.251-276.
- Habib, M. and Islam, K.U., 2017. Impact of macroeconomic variables on islamic stock market returns: Evidence from NIFTY 50 Shariah Index. *Journal of Commerce and Accounting Research*, 6(1), p.37.
- Hunjra, A.I., Chani, D., Irfan, M., Ijaz, M.S. and Farooq, M., 2014. The impact of macroeconomic variables on stock prices in Pakistan. *International Journal of Economics and Empirical Research*, 2(1), pp.13-21.
- Huy, D.T.N., Dat, P.M. and Anh, P.T., 2020. BUILDING AN ECONOMETRIC MODEL OF SELECTED FACTORS'IMPACT ON STOCK PRICE: A CASE STUDY. *Journal of Security & Sustainability Issues*, 9.
- Laichena, K.E. and Obwogi, T.N., 2015. Effects of macroeconomic variables on stock returns in the East African community stock exchange market. *International journal of education and research*, 3(10), pp.305-320.
- Liya, A., Qin, Q., Kamran, H. W., Sawangchai, A., Wisetsri, W., & Raza, M. (2021). How macroeconomic indicators influence gold price management. *Business Process Management Journal*.
- Loo, W.K., Anuar, M.A. and Ramakrishnan, S., 2016. Integration between the Asian REIT markets and macroeconomic variables. *Journal of Property Investment & Finance*, 34(1), pp.68-82.
- Muhammed Al-Kassab, M. (2022). THE EFFECT OF SOME MACROECONOMIC VARIABLES ON STOCK MARKET MOVEMENT IN IRAQ. *Advances and Applications in Statistics*, 73, 1-16.
- Megaravalli, A.V. and Sampagnaro, G., 2018. Macroeconomic indicators and their impact on stock markets in ASIAN 3: A pooled mean group approach. *Cogent Economics & Finance*, 6(1), p.1432450.
- Mumo, M.P., 2017. Effects of macroeconomic volatility on stock prices in Kenya: A cointegration evidence from the Nairobi Securities Exchange (NSE). *International Journal of Economics and Finance*, 9(2), pp.1-14.
- Olokoyo, F. O., Ibhagui, O. W., & Babajide, A. (2020). Macroeconomic indicators and capital market performance: Are the links sustainable? *Cogent Business & Management*, 7(1), 1792258.
- Queku, I.C., Gyedu, S. and Carsamer, E., 2020. Stock prices and macroeconomic information in Ghana: speed of adjustment and bi-causality analysis. *International Journal of Emerging Markets*.
- Ray, S., 2012. Testing granger causal relationship between macroeconomic variables and stock price behaviour: evidence from India. *Advances in Applied Economics and Finance*, 3(1), pp.470-481.
- Tripathy, N. (2011). Causal relationship between macro-economic indicators and stock market in India. *Asian Journal of Finance & Accounting*, 3(1), 208-226.

